TEL-TONE* M-112 MINICONVERTER*
TOUCH-TONE® SERVICE ON
STEP-BY-STEP SYSTEMS
TRAFFIC AND EQUIPMENT ENGINEERING

1. GENERAL

1.01 This section covers the Tel-Tone M-112 Miniconverter tone-to-pulse conversion system.

1.02 The manufacturer's Technical Bulletin M-112-800 is included as part of this section to describe Traffic engineering information, ordering of components and spare parts. A description of installation consideration is also included to aid well integrated planning.

1.03 This tone-to-pulse system may be applied to Private Branch Exchange (PBX) service. The Tel-Tone M-112 Miniconverter permits an existing rotary dial telephone installation to serve Dual Tone Multi-Frequency (DTMF) signaling telephones without disrupting rotary service.

2. ASSOCIATED SECTIONS

2.01 This section covers the Traffic engineering, installation and maintenance engineering of the system. Associated BSP sections are assigned to other Technical Bulletins issued by the Tel-Tone Corporation. The BSP numbers, the Tel-Tone numbers, and subjects covered are as follows:

(a) 534-366-920PN/M-112-100 Description.

(b) 534-366-921PN/M-112-200 Installation, alignment and initial adjustments.

(c) 534-366-922PN/M-112-400** Functional description of equipment cards, connections and wiring options.

(d) 534-366-923PN/M-112-500** Maintenance, test procedures and trouble shooting.

(e) 814-300-920PN/M-112-800 Traffic engineering, ordering components and spare parts.

Note: ** Indicates these technical bulletins are not available at time of release of this BSP.

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M-112 MINICONVERTER T.M. TONE TO PULSE ALLOTTER SYSTEM

1. GENERAL

1.01   This Bulletin Section provides a brief overview of the TEL-TONE® M-112 MINICONVERTER^T.M. tone-to-pulse conversion system, traffic engineering information, and ordering information for components as well as spare parts. A description of installation considerations is also included to aid well integrated planning.

1.02   A general description of the unit, its operation, applications, and capabilities are presented in Bulletin Section M-112-100.

1.03   Installation details, alignment procedures, and initial adjustments are described in Bulletin Section M-112-200.

1.04.   Maintenance test procedures, and a trouble-shooting guide are given in Bulletin Section M-112-500.

2. CONCEPT

2.01   The M-112 permits an existing rotary dial telephone installation to service Dual Tone Multi Frequency (DTMF) signaling telephones without disrupting rotary service. The MINICONVERTER converts DTMF (TOUCH TONE®) signals to dial pulses while passing rotary dial signals directly to the first selectors, trunk lines, or other equipment. It is intended for use in Private Branch Exchanges (PBX) and small Central Office installations using step-by-step, crossbar, or other systems needing tone-to-pulse conversion for up to 20 linefinders or trunks carrying DTMF in whole or in part.

2.02   The MINICONVERTER design takes advantage of the relative shortness of dial signaling time compared with the total length of a call. Since the tone-to-pulse converters are needed for only a fraction of the time the subscriber is off-hook the Register-Senders (the actual converters) are time-shared between the Ports. Fewer units are needed so costs and complications are reduced. Since all subscribers connected to the Ports get their dial tone from the M-112 Register-Sender, whether using rotary dial or DTMF instruments, it is imperative the Register-Senders not be tied up unnecessarily. The early drop-off programs make the time-sharing of the Register-Senders as efficient as possible in concert with other features of the unit.

(A)   System functions

2.03   The Common Control scans the Register-Senders in numerical sequence until it finds one available (see figure 1). It holds on that Register-Sender and polls the Ports in numerical sequence until one of them takes the available Register-Sender. When a Port has both a ground on its C-lead and a need for a Register-Sender the receipt of its Port Address and the address of the available Register-Sender enables the Port to connect to that Register-Sender. The connection activates the Register-Sender and signals the Common Control that this Register-Sender is now busy. The Common Control then continues to scan the Register-Senders for availability. When the Register-Sender is ready to convert tones to pulses it connects dial tone back to the subscriber. If no Register-Sender is available, the subscriber may experience a brief delay in getting dial tone until a Register-Sender becomes available.

2.04   If the subscriber has a rotary dial instrument the Register-Sender detects the first pulse break as a loss of loop current. It signals the Port to disconnect (release) if the loss of loop current persists for 30 milliseconds (ms). Before the first dial pulse has ended, the Register-Sender has been disconnected (which cut off dial tone), deactivated, and can be assigned to another Port.

2.05   A DTMF signal from the subscriber causes the Register-Sender to split the line in less than 20 ms to prevent the signals from affecting other tandem equipment. If the DTMF tone pair persists for 40 ms it is latched and written into Memory when the subscriber lets the digit button up. The ordinal information and value of the digit are also sent to the Common Control for comparison against the early drop-off programs.

2.06   If the tone pair does not last long enough to be latched, the next Interdigital Time Out (IDTO) pulse that finds no digit in Memory will cause the line to be restored to normal (not split). The Interdigital Timer free-runs, producing an IDTO pulse about every 500 ms, except when it is clamped off during outpulsing and when it is set at 600 ms by the actual end of an outpulsed digit. The pulse's function then is to get the next digit from Memory. But, Memory is interrogated for a digit each time an IDTO pulse is generated. If it finds no digit, the line will be restored to normal.

2.07   When there is a digit in Memory the arrival of an IDTO pulse causes it to be read from Memory and
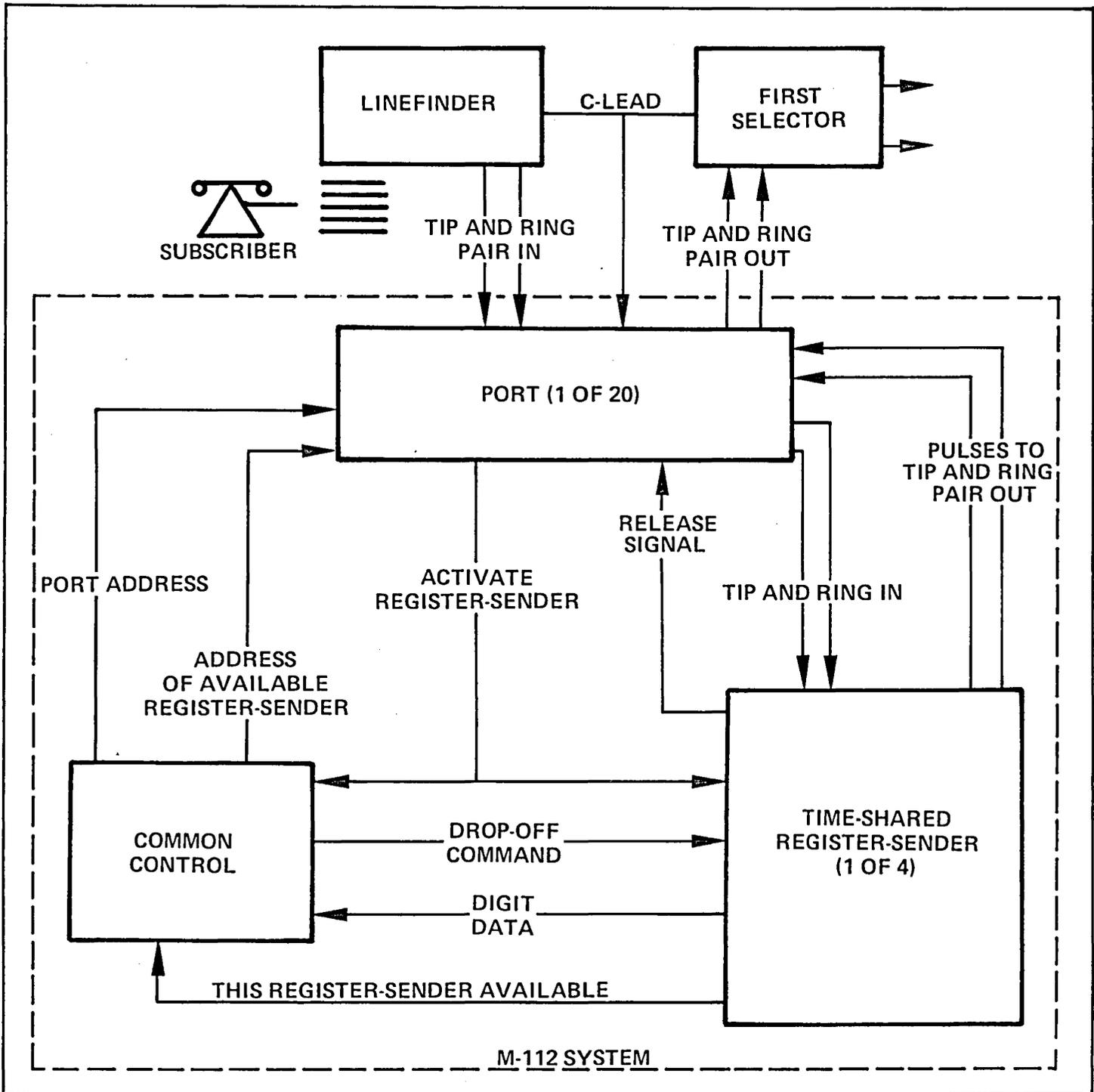
FIGURE I   BASIC CONCEPT OF THE M-112 MINCONVERTER

sent to the Pulse Sender for outpulsing as a rotary-type signal of make-break pulses. If it is the first digit of a call, the dial tone to the subscriber is removed just prior to its outpulsing. As succeeding digits arrive the Pulse Sender may be busy pulsing or waiting for an interdigital time to expire (no IDTO pulses being generated). In that case Memory will store the digits until the Pulse Sender is ready to send them out at the proper rate. Memory can store up to 16 digits, which is necessary because DTMF signals can be generated much faster than digits are outpulsed.

2.08 The Register-Sender will accept DTMF digits signaled as closely as 40 ms. If the Register-Sender Release Time-Out period (adjustable from 3 to 15 seconds) expires before a DTMF signal is received the Register-Sender will be disconnected from the Port. The Release Time-Out starts when · the Register-Sender is activated, or when a digit button-up is detected, or when a loop current reversal is detected during an interdigital time.

2.09 A stop-dial loop current reversal during interdigital time will stop further outpulsing but the Register will continue to accept digits and send them to Memory. If the loop current reversal (answer supervision) is detected when interdigital time is not in process the Register-Sender simply releases.

(B) . The Early Drop-off Programs

2.10 Obviously, if the Register-Senders do not release until the time-out period (up to 15 seconds) expires after the last digit of every call they will be unavailable to service other Ports a great part of the time. To better implement the time-sharing of the Register-Senders the Common Control includes a set of early drop-off programs. These command the Register-Sender to release one interdigital time (600 ms) after the last digit has been outpulsed. They also inhibit the Register from accepting more than the prescribed number of digits by disabling the guard time circuit in the Register-Sender logic.

2.11 The drop-off programs are initiated by selected first digits codes. The codes are set by the system user to meet his special requirements. There are two sets of programs: one designed for PBX installations and one designed to better match the needs of a Central Office installation. The two program sets require different Common Control cards. See table 1.

2.12 The PBX early drop-off programs are a first digit release, a first-two digits release, a release after "X" number of digits, and a release after "Y" number of digits. All the code digit values for the PBX programs are set by rocker switches on the Decoder and Program Switches card of the Common Control. Each rocker switch can be set for all, any, or none of the digit values from zero to nine. The number of digits before drop-off occurs for the "X" and "Y" programs are prescribed by rotary and screw switches on the Decoder and Program Switches card.

2.13 The Central Office early drop-off programs

include a first digit release, a first-two or first-three digits release, a first-three digits with optional release after "X" number of digits (if not used by the first-three digits code the release after "X" number of digits can be initiated with its own first digit code), and a release after "Y" number of digits program.

2.14 All the code digit values for the Central Office programs are set by rocker and rotary switches on the Decoder and Program Switches card of the Common Control. The number of digits before drop-off occurs for the "X" and "Y" programs are set by rotary and screw switches on the Decoder and Program Switches card. Whether the first-two or first-three digits release is two or three is determined by a screw switch on the Receiver and Program Outputs card. Similarly, if the first-three digits code is to use the release after "X" number of digits program, or not, is determined with a screw switch on the Receiver and Program Outputs card.

2.15 A first digit drop-off program releases the Register-Sender one interdigital time after the programmed digit has been outpulsed.

2.16 A first-two digits drop-off program releases the Register-Sender one interdigital time after both programmed digits have been outpulsed.

2.17 A first-three digits drop-off program releases the Register-Sender one interdigital time after all three programmed digits have been outpulsed.

2.18 The first-three digits with the release after "X" number of digits program uses the first three digits (set by rotary switches) as the code to release the Register-Sender one interdigital time after the prescribed ("X") number of digits have been outpulsed. For instance, if the three digit code was 112 and "X" was set at ten: the Common Control would recognize the first three dialed digit values of one, one, and two as being the code for this program. Then, after the succeeding seven digits had been outpulsed the Common Control would command the Register-Sender to release.

2.19 A release after "X" or "Y" number of digits drop-off program initiates when the prescribed first digit value is recognized by the Common Control as being the code for that particular program. The Common Control prevents the Register from accepting more than the prescribed number of digits and commands the Register-Sender to release one interdigital time after the prescribed number of digits have been outpulsed—including the code digit.

PBX CONVERTER DROP-OFF PROGRAMS		Receiver and Program Outputs card 201-00140-01 Decoder and Program Switches card 201-00145-01	
PROGRAM	DIGIT ORDER	CODE DIGITS VALUE SET BY	NUMBER OF DIGITS PROGRAMMED BY
first digit release	first	S3 rocker	
first-two digits release	first second	S1 rocker S2 rocker	
release after "X" number of digits	first	S4 rocker	S6 rotary screw A for "X" 10-16 screw B for "X" 1-9
release after "Y" number of digits	first	S5 rocker	S7 rotary screw C for "Y" 10-16 screw D for "Y" 1-9

CENTRAL OFFICE CONVERTER DROP-OFF PROGRAMS		Receiver and Program Outputs card 201-00017-01 Decoder and Program Switches card 201-00021-01	
PROGRAM	DIGIT ORDER	CODE DIGITS VALUE SET BY	NUMBER OF DIGITS PROGRAMMED BY
first digit release	first	S8 rocker	
first-two or first-three digits release	first second third	S11 rocker S10 rocker S9 rocker	on Outputs card two-digits: screw S2-A three-digits: screw S3-A
first-three digits release with optional release after "X" number of digits	first second third	S5 rotary S4 rotary S3 rotary	If "X" to be used put screw in S1-A on Outputs card. Switches card S1 rotary screw A for "X" 10-16 screw B for "X" 1-9
release after "X" number of digits	first	S7 rocker if screw in Outputs S1-B	S1 rotary screw A for "X" 10-16 screw B for "X" 1-9
release after "Y" number of digits	first	S6 rocker	S2 rotary screw C for "Y" 10-16 screw D for "Y" 1-9
NOTE: Each rocker switch can be set for all, any, or none of the digit values from zero to nine (rocker marked 10 on the switch is digit value zero). Switches are located on the Decoder and Program Switches card unless indicated otherwise.			

TABLE 1   M-112 DROP-OFF PROGRAMS

2.20 For more explicit details on setting the drop-off programs see Section 200.

Register-Sender	
insertion loss	0.5 dB maximum
input level	0.0614 VRMS to 1.55 VRMS*
input impedance	+30K ohms
digit detection	35-40 ms
bandwidth	±1.5% minimum ±2.5% maximum
Register storage	16 digits, binary code
Release Time-Out	adjustable from 3 to 15 seconds
Pulse Sender	
pulse speed	10 PPS ±0.5** 20 PPS ±1
pulse ratio	at 10 PPS: 60% break, 40% make** adjustable from 42% to 68% break
pulsing relay	mercury wetted contacts
interdigital time	600 ms** adjustable from 500 to 800 ms
Dial tone input optional	0.7746 to 15 VRMS* TEL-TONE M-155 Precise Dial Tone Generator: 350 plus 440 Hz ±2%
Voltage	44-56 VDC, positive ground
Current	2.5 amps maximum 600 ma idle
Fusing	1 1/3 amps indicating type
Temperature limits	0° to 55° C

* Input levels are expressed in VRMS because the Register-Senders are essentially voltage sensitive devices with an input impedance of over 30K ohms. They are not terminated in a lower impedance in use; the measurement is made with an unterminated voltmeter. The same amount of power as one milliwatt into 600 ohms would read as 0.7746 VRMS.

** Setting established at factory

TABLE 2
M-112 MINICONVERTER SPECIFICATIONS

3. TRAFFIC CONSIDERATIONS

3.01 The MINICONVERTER is designed for PBX installations and small Central Offices needing tone-to-pulse conversion either in whole or in part. Each M-112 can serve up to 20 linefinders or trunks, one to each Port. Not every installation would need the full four Register-Senders. Similarly, some installations with saturation DTMF traffic would need equipment providing closer to full-time access to a converter than the M-112's time-shared usage. Saturation DTMF traffic could also be split between more than one M-112.

3.02 How many Register-Senders will be required to provide adequate service to a given number of Ports depends on several factors as can be seen from table 3. This table provides examples of decision information presuming the particular considerations it indicates.

3.03 How adequate service is defined makes some difference. If a Register-Sender is available, the dial tone to the subscriber will be connected by the Register-Sender in less than 60 ms from when the C-lead ground reaches the Port. Unlike much telephone equipment the subscriber does not get a busy signal and have to reinitiate the call if a Register-Sender is not immediately available. The subscriber would only experience a brief delay in getting dial tone until a Register-Sender became available. For instance the grade of service figures given in table 3 indicate, for P=.001, that one in a thousand calling subscribers could get a delay in dial tone slightly longer than normal (about 250 ms).

3.04 The utility of time-sharing the Register-Senders is based on the fact that digit signaling and pulsing amounts to a small portion of the time the subscriber is off-hook and connected to a Port. Table 3 presumes the average call to last three minutes (1.8 CCS). The DTMF digits are usually signaled much quicker than they can be outpulsed and are stored in Memory to be fed to Sender Control and pulsed out with just an interdigital time between them (600 ms). This outpulsing is faster than is possible with a rotary dial telephone. The longest possible seven-digit number (seven zeros) would take only 11.2 seconds to outpulse; other numbers would take much less time. The early drop-off programs assure the Register-Senders are released one interdigital time after the last digit is outpulsed for the majority of calls. If the subscriber had a rotary dial instrument the Register-Sender would not be

LINEFINDERS OR TRUNKS	3 DIGIT NUMBERS 100% TOUCH TONE GRADE OF SERVICE P .001	7 DIGIT NUMBERS 100% TOUCH TONE GRADE OF SERVICE		7 DIGIT NUMBERS GRADE OF SERVICE P .001 PERCENTAGE OF TOUCH TONE EQUIPPED						
	P .001	P .01	P .001	80%	70%	60%	50%	40%	30%	20%
1	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2
3	2	2	2	2	2	2	2	2	2	2
4	2	2	3	3	3	3	2	2	2	2
5	3	2	3	3	3	3	2	2	2	2
6	3	2	3	3	3	3	3	3	2	2
7	3	3	3	3	3	3	3	3	3	2
8	3	3	4	3	3	3	3	3	3	2
9	3	3	4	4	3	3	3	3	3	3
10	3	3	4	4	4	3	3	3	3	3
11	3	3	4	4	4	3	3	3	3	3
12	4	3	4	4	4	4	3	3	3	3
13	4	3	4	4	4	4	4	3	3	3
14	4	3	—	4	4	4	4	3	3	3
15	4	4	—	4	4	4	4	4	3	3
16	4	4.	—	—	4	4	4	4	3	3
17	4	4	—	—	4	4	4	4	3	3
18	4	4	—	—	—	4	4	4	4	3
19	4	4	—	—	—	4	4	4	4	3
20	—	4	—	—	—	—	4	4	4	3

The Grade of Service is modified from the standard definition in that a dial tone delay will occur rather than a busy signal if the traffic exceeds the capacity of the system.

Quantities are based on a 1.8 CCS call holding time and a Register-Sender holding time based on 2.0 seconds delay after transmittal of dial tone to receipt of first digit plus 1.2 seconds to pulse each digit. Quantities listed under the seven-digit numbers presume 6% being ten-digit numbers to approximate standard Central Office conditions.

TABLE 3   NUMBER OF REGISTER-SENDERS REQUIRED

occupied any longer than it takes him to dial the first digit (see paragraph 2.04), probably no more than three seconds.

3.05   To develop data similar to table 3 for different consideration requires two standard tables and the following procedure of steps A through L to calculate the number of Register-Senders needed for each combination of number of linefinders and degree of service. Both a Linefinder Capacity Table (in CCS) and a Trunk Loading Capacity For Full Availability Table are needed.

3.06   Using the Linefinder Capacity Table (STEP A) determine the amount of traffic (in CCS) the linefinder group will carry. This will mean selecting the grade of service desired against the number of linefinders being used. The length of the average call must then be determined (STEP B) in CCS. For table 3 a figure of three minutes (1.8 CCS) was used.

3.07   The maximum number of calls that the linefinder group can handle in one hour (to cover worst case conditions) is determined (STEP C) by dividing the average call length (CCS) into the

linefinder capacity (CCS). That is: A/B to get C.

3.08 The average Register-Sender holding time is the sum of the times for each step from the instant the Register-Sender connects dial tone to the subscriber until the Register-Sender is released from the Port. First there is the subscriber hesitation (STEP D) from the time dial tone is returned until the first digit is signaled. The standard figure for this is two seconds but other periods can be used. Then there is the time required to pulse each digit (STEP E) which is usually assumed to be 1.2 seconds to allow for the various lengths of digits plus interdigital time and subscriber hesitation between digits. The five per cent of calls that cannot be programmed for early drop-off and will require the Register-Sender Release Time-Out to expire are included in this figure too. The number of digits to be signaled (STEP F) must be considered and multiplied by the pulsing time per digit (STEP G) to generate an average pulsing time. That is: E multiplied by F to generate G. By adding these up (STEP H) the average Register-Sender holding time is determined. That is: D plus G gets H.

3.09 The number of call seconds the Register-Sender will be used (STEP I) is the product of the average Register-Sender holding time and the number of calls per hour (C from paragraph 3.07). That is: H multiplied by C to get I. If DTMF traffic is less than 100 per cent use that percentage of the call seconds figure (STEP J). For instance, if only 70 per cent of the traffic is DTMF then multiply the call seconds figure by 0.7. The final call seconds figure is then divided by 100 to convert it to CCS (STEP K).

3.10 By taking the Register-Sender call seconds, in CCS, (K) and checking it (STEP L) against the rate of service desired on the Trunk Loading Capacity For Full Availability Table you arrive at how many Register-Senders will be needed. Simply take the table's recommendation for number of trunks and use it as the required number of Register-Senders.

4. INSTALLATION CONSIDERATIONS

(A) Space

4.01 The M-112 mounts directly onto a standard 23-inch frame; no mounting bars are needed. It takes up 14 inches of vertical space and is only seven inches deep. A cabinet, similar to a key cabinet, is available from TEL-TONE for wall-mounted installations; order it as M-436.

4.02 The unit must be mounted vertically, otherwise the mercury in the mercury wetted contacts pulsing relays will place a 150 ohm shunt across the Tip and Ring pair.

(B) Inputs and connections

4.03 Except for ground, battery, and dial tone all the connections to the M-112 are made to wire wrap terminals (24-gauge wire is suggested). The ground, battery (-48V), and dial tone inputs are screw terminal connections for which at least 18-gauge wire is suggested.

(C) Signal path

4.04 Until power is applied the Tip and Ring IN connections have a direct metallic path to Tip and Ring OUT. The unit can be wired in completely parallel to existing equipment without affecting its operation until power is applied to the M-112. By disabling dial tone in each first selector when the original Tip and Ring path is broken each pair can be brought on-line individually after the MINICONVERTER is switched on (see Bulletin Section 200).

5. ORDERING M-112 MINICONVERTER UNITS

5.01 The M-112 is designed for flexibility in many applications with several options available in both system size and system capabilities. The various sets of components are ordered as units. This section identifies each unit by its system capability and lists the components that comprise that unit. Any M-112 system may consist of from two to four Register-Senders and two to twenty Ports. For that reason the Register-Senders and Ports are ordered as units separately from the system units. Individual components may also be ordered and are listed in section 6.

(A) PBX system: M-112-01

5.02 This unit includes the Housing Assembly and the three Common Control cards for the PBX early drop-off programs (see table 1) plugged into the large back interconnection card. The flat cable harness is plugged into dummy panels where Register-Senders have not been ordered.

REGISTER-SENDER CONFIGURATION OPTIONS		
OPTION	CARD	SCREW POSITION
Buttons up (only)	E	A*
Pulse Rate 10 PPS	F	A*
Pulse Rate 20 PPS	F	B
Continuous outpulse, NO	F	D*
Continuous outpulse, YES	F	C
Loop current loss release, 30 ms	F	E*
Loop current loss release, 180 ms	F	F
Reversal release yes	G	A*
Reversal release no	G	B
Dial pulse feedback, YES	G	C*
Dial pulse feedback, NO	G	D
*set at factory		

OPERATION ADJUSTMENTS		F CARD
Release Time-Out (3 to 15 seconds)	8*	front panel
Pulse ratio (42 to 68% break)	60*	front panel
Interdigital time (500 to 800 ms)	600*	R-23
*set at factory		

TABLE 4
REGISTER-SENDER
CONFIGURATION OPTIONS

(B) Central Office System: M-112-04

5.03 Except for the two different Common Control cards for the Central Office early drop-off programs (see table 1) this unit is the same as the PBX system unit.

(C) Register-Sender cards: M-112-02

5.04 This unit includes the back connecting card and the five cards for locations C, D, E, F, and G that make up one Register-Sender which does the actual tone-to-pulse conversion. If the ANI Forwarding card is not ordered, a dummy bracket for location H is

included. The M-112 system may use up to four of these Register-Sender units. Some aid in determining how many Register-Senders will be needed in a given system is provided in section 3 of this Bulletin Section.

5.05 If ordered with a PBX system unit or a Central Office system unit the Register-Sender units will be factory-installed in the housing assembly. When the Register-Sender unit has been ordered to expand an existing M-112 installation the cable harness is unplugged and the dummy back panel is removed. Then the A card connector is installed and the two wire wrap connections (DT and GRD) from the

Housing Assembly	106-00042-01
Address and Data Scanners card	201-00139-01
Receiver and Program Outputs card	201-00140-01
Decoder and Program Switches card	201-00145-01

TABLE 5   UNIT M-112-01 (one each)

Housing Assembly	106-00042-01
Address and Data Scanners card	201-00139-01
Receiver and Program Outputs card	201-00017-01
Decoder and Program Switches card	201-00021-01

TABLE 6   UNIT M-112-04 (one each)

Discriminator card, location C	201-00154-01
Logic and Power Supply card, location D	201-00075-03
Register card, location E	201-00077-03
Sender Control card, location F	201-00117-03
Line Interface card, location G	201-00142-01
Register-Sender Connector panel	201-00143-01

TABLE 7   M-112-02 (one each)

power distribution terminals are established. The cable harness is connected to the plugs on the back of A card, the five Register-Sender cards are inserted, and the installation is complete.

(D) Dual Port card: M-112-03

5.06 Each Dual Port card, ordered as unit M-112-03, provides complete accessing circuitry for two Ports. A double banana jack on the front panel of the card is provided for testing each Port. The banana jacks connect across the Tip and Ring IN pair and are also used to access the Register-Senders for testing and maintenance. An M-112 system may include from two to twenty Ports and use from one to ten Dual Port cards (part no. 201-00141-01). The exact number is determined by how many linefinders or trunks require DTMF conversion in whole or in part.

(E) ANI Forwarding card: M-112-05

5.07 Not every MINICONVERTER installation will need the Automatic Number Identification (ANI) forwarding provided by this location H card. It is ordered as unit M-112-05. If the function is needed a location H card (part no. 201-00150-01) is needed for each Register-Sender in use. While the line is split in the Register-Sender an imbalance across the Tip and Ring pair is not sent beyond the M-112 without the ANI Forwarding Card. The imbalance indicates the Tip party of a two-party line is the one off-hook.

(F) Wired-in Amphenol connector option

5.08 The M-112 can be ordered with wired-in Amphenol connectors to allow cabling the C-leads, Port Inhibit leads, and the Tip and Ring pairs between the unit and the switching train. There are three connectors: one for a cable of Tip and Ring pairs from the linefinder, one for a cable of Tip and Ring pairs from the first selector, and one to connect all the C-leads and Port Inhibit leads. The PBX system (same as M-112-01) with wired-in Amphenol connectors is ordered as M-112-06. The Central Office system (same as M-112-04) with wire-in Amphenol connectors is ordered as M-112-07.

6. ORDERING M-112 MINICONVERTER COMPONENTS

6.01 Individual components may be ordered as

replacements for irreparably damaged components. If returned with postage prepaid, circuit cards will be repaired for a flat rate per card.

6.02 With the exception of the Housing Assembly all the components listed in table 8 are single discrete items. They are ordered by the ten-digit part numbers shown when not included as parts of a unit order. Detailed information on each board is provided in the other Bulletin Sections.

Housing Assembly (see table 9)	106-00042-01
Discriminator card, location C	201-00154-01
Logic and Power Supply card, location D	201-00075-03
Register card, location E	201-00077-03
Sender Control card, location F	201-00117-01
Line Interface card, location G	201-00142-01
Register-Sender Connector panel	201-00143-01
Address and Data Scanners card	201-00139-01
PBX Receiver and Program Outputs card	201-00140-01
PBX Decoder and Program Switches card	201-00145-01
C.O. Receiver and Program Outputs card	201-00017-01
C.O. Decoder and Program Switches card	201-00021-01
Systems Connector panel	201-00144-01
Fuse, BUSS GMT 1 1/3	611-01004-01
M-112 Technical Bulletin, all sections	M-112

TABLE 8
M-112 MINICONVERTER COMPONENTS

(A)   Housing Assembly: 106-00042-01

6.03   When ordered separate from a system unit, the Housing Assembly includes a Systems Connector panel, the metal frame, the insulating back cover, and the complete Power Distribution assembly as listed in table 9 with ten fuses.

Systems Connector Panel	201-00144-01
Power Distribution Connector panel	201-00029-01
Power Distribution Board Assembly (Fuse and Alarm card)	201-00028-01
Fuses (10) BUSS GMT 1-1/3	611-01004-01
Insulating Cover	103-00011-01

TABLE 9
HOUSING ASSEMBLY 106-0042-01

(B)   Technical Bulletins

6.04   The M-112- Technical Bulletin includes four Bulletin Sections as listed in section 1 of this Section. A full set is provided with each system unit. More copies can be ordered from Tel-Tone Corporation. A drawing package with functional circuit descriptions can also be ordered as M-112 Drawing Package.